

ABSTRACTS
OF
THE PAPERS PRINTED IN
THE PHILOSOPHICAL TRANSACTIONS.

Additional Observations on the optical Properties and Structure of heated Glass and unannealed glass Drops. By David Brewster, LL.D. F.R.S. Edin. and F.S.A. Edin. In a Letter addressed to the Right Hon. Sir Joseph Banks, Bart. K.B. P.R.S. Read November 10, 1814. [*Phil. Trans.* 1815, p. 1.]

IN this continuation of the author's remarks on Rupert's drops, he observes, that when they are made of colourless glass, and are held before a sheet of white paper, even the unbroken drops exhibit some appearances which he considers as marks of a crystalline texture; and when they are broken in such a manner that the parts are retained in their relative situation, the structure shows a cleavage in the direction of lines diverging from the apex, or rather in the form of conical layers, having a common axis, with their apex towards the blunt end of the drop.

Since the surface of these drops is cooled suddenly by plunging into water, and fixed before the central parts are contracted, the author conceived that their specific gravity might be less than that of annealed drops; and indeed a difference was found upon trial, amounting to $\frac{1}{4}$ th part in the aggregate bulk of its external dimensions; but it appeared, on examination, that the contraction of the glass had taken place from within outwards, so as to leave cavities in the interior sufficient to account for the difference of weight, without supposing any intrinsic difference of density in the glass itself.

Dr. Brewster further observed, that by heating a drop to redness, and allowing it to cool gradually, these cavities disappeared entirely, so as to prove that they did not arise from included air, but merely from the internal contraction of the glass.

Since considerable difficulty occurs in preserving unannealed drops of flint glass, the author has paid attention to the circumstances most favourable to their preservation, and recommends removing them

from the water in which they have been plunged, as soon as the redness in the centre of the drop ceases to be visible.

Since the smallest portion of any polarizing crystal polarizes or depolarizes light according to its position, the author expected to find the same property in the fragments of a broken drop, but upon trial they did not appear to possess this property.

Of the many important conclusions to which the author thinks that these experiments are calculated to conduct us, there is one which he considers too palpable to be passed over, namely, that when the particles of glass are separated to a certain distance by the expansive agency of heat, they assume a crystalline arrangement, which would not be discovered but by fixing them in this state by sudden cooling; since the gradual approximation of the particles, by slow cooling, entirely destroys the crystalline structure thus produced.

In a note the author remarks, that on more than one authority steel is said to be less dense after being hardened by quenching than before, which he ascribes, as in glass, to the sudden induration having commenced at the surface. And he takes occasion to suggest the possibility, that under these circumstances moderate changes of temperature may not occasion any degree of expansion, and that we may obtain, within certain limits, a substance of invariable length that may be useful for pendulums.

Description of a new Instrument for performing mechanically the Involution and Evolution of Numbers. By Peter M. Roget, M.D. Communicated by William Hyde Wollaston, M.D. Sec. R.S. Read November 17, 1814. [*Phil. Trans.* 1815, p. 9.]

The present instrument depends upon a new extension of the principle of the common sliding-rule; for as in that numbers themselves are multiplied or divided by the mechanical addition of their logarithms, so in this their logarithms are multiplied or divided by mechanical application of corresponding logometric spaces.

In the common tables of logarithms, that of 10 is 1, and those of its simple powers are 2, 3, 4, &c.; so also the logarithm of the square root of 10 is $\frac{1}{2}$, or $\cdot 5$; the fourth root is $\frac{1}{4}$, or $\cdot 25$, being a decimal index expressing a power of 10 less than unity. In the same manner all other numbers are considered as powers of 10, and their logarithms are integral or decimal indices of those powers.

In the common sliding-rules the divisions are so placed as to mark intervals that are proportional to these indices; so that by simple juxtaposition the sum or difference of any two indices, and consequently the product or quotient of any two numbers, appears by inspection.

In this manner, by addition of two equal logometric intervals, the square of any number may be found; but the instrument so constructed is not prepared to give the higher powers, without proportionally frequent repetitions of the same process, which gives at length a multiple of the index by the tedious operations of repeated addition.